



DEPARTMENT OF CHEMISTRY
NUCLEAR REACTOR FACILITY
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U.S. Nuclear Regulatory Commission,
Region V,
1450 Maria Lane, Suite 210,
Walnut Creek, CA 94596
Attention: D.F. Kirsch, Chief, Reactor Safety Branch

July 9th 1991

50-326
Docket: ~~55-326~~ - License R-116

Licensee Report of Abnormal Occurrence - UC Irvine Nuclear Reactor
Reported in Accordance with Reactor Technical Specifications, Section 6.7.c.3

Gentlemen:

On July 3rd 1991, a Senior Reactor Operator was starting operation to calibrate the SHIM control rod on our TRIGA reactor when she noticed that an unusually short period was generated when only a modest period should have resulted from the amount of SHIM rod inserted. On an attempt to repeat the insertion cycle, she noticed that the REG rod, which should remain stationary at an intermediate position during the SHIM movement was slowly rising, this creating the unusual reactivity insertion. She scrammed the reactor and brought the matter to the attention of the Reactor Supervisor. With all other control rods inserted, and thus the reactor shutdown by over \$6.00, the Supervisor operated the REG rod and confirmed that even when the UP button was released the rod continued its upward movement in a reproducible manner. This constituted a "uncontrolled or unanticipated change in reactivity" and so is an Abnormal Occurrence as defined in Section 1.13.e. of the Technical Specifications for the facility.

At no time did the period exceed the non-required PERIOD SCRAM setting of 3 seconds, nor did the power level exceed any scram setting. In fact power was less than 1 kilowatt during operation, since all control rod calibrations are necessarily done at power levels below this value. Since for a TRIGA reactor it is well established that *pulsed* reactivity insertions of well over the full value of the REG rod (\$2.92) are permissible and safe, THERE WAS NO SAFETY HAZARD NOR ANY DECREASE IN SAFETY MARGINS AS A RESULT OF THIS INCIDENT. The failure is purely one of annoyance to standard operations since control rods are supposed to stay where they are put! All functions of the rod drive were normal (i.e: response to UP or DOWN button press, SCRAM, and "auto" drive down features) except for the upward drift when supposed to remain stationary.

Suspicion as to cause immediately fell on the drive UP or DOWN switches because of a warning memo received from the reactor manufacturer(2-15-89). However, extensive tests and thorough examinations of switching circuits failed to confirm this was the cause. Attention was next given to the control rod circuitry at the reactor bridge location. On previous occasions, failure had been noted of a 220 ohm 2 watt resistor in the balancing circuit for the two motor windings. This has been replaced at least twice before in the lifetime of this facility, each time as a result of inspections conducted while the reactor was not in operation, so not in those cases, resulting in an Abnormal Occurrence situation.

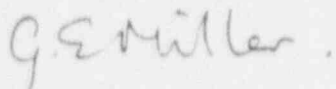
The resistor had a measured resistance of 450 ohms instead of 220 ohms showing aging as a result of overheating. Replacing the resistor with a new one did not cure the problem, the REG rod drive still responded in the inappropriate way, with continual upward drift.. Careful further inspection and diagnosis revealed that there had developed a leakage current pathway on the circuit board allowing current to flow through the resistor, bypassing the series variable resistor provided for balance adjustment, and bypassing the drive DOWN motor winding, thus giving preference to the UP direction. In normal DOWN operations, this whole section is designed to be shorted and so does not affect normal drive down functions. As this pathway did not take all the current, nor was it diagnosable by low voltage resistance measurements, it was not readily apparent as the cause of the problem.

On July 8th 1991, the resistor was replaced with a 200 ohm 5 watt resistor (TRW PW5 style), mounted so as to be well cooled by air, and bypassing the suspect(browned) portion of the circuit mounting board. Full normal rod drive function was obtained, and the variable potentiometer could again be used to obtain proper balance of up and down rod movement to allow for the weight of the fuel follower on the rod.

It is postulated that the circuit board carbonization occurred as a combined result of resistor heating in normal use and soldering and unsoldering activities carried out during this and former resistor replacement efforts. The new arrangement and higher wattage resistor will provide better cooling and longer time to failure.

This incident was reported by telephone to the NRC Emergency number at approximately 5:20 pm on 7/3/91 in accordance with Technical Specifications 6.7.b.3.

Sincerely yours,



George E. Miller
Reactor Supervisor

cc: Reactor Operations Committee members
Senior Operator, Dr Patricia Rogers
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